User Manual

HWIO-Gateway

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1. Product overview

The INUX HWIO-Gateway will allow any Modbus compatible device to utilize the Honeywell/INU digital and analog I/O-boards. It has the following features

- Analog and digital I/O-boards stack for communication with up to 16 Honeywell/INU I/O-boards.
- Modbus-TCP interface.
- Modbus-RTU (RS-232) interface.
- Webserver for easy configuration and diagnostics.

2. License

The gateway is available in three different configurations with support for 2, 8 or 16 I/O boards. If the number of boards connected to the gateway exceed this limit, all boards will irreversibly go to a suspended state after 10 minutes. In this case disconnect exessing boards and do a power cycle of the gateway to resume communication.

3. Operation

The gateway will automatically detect I/O-boards attached to the RS485 multidrop network and start communication. Additional I/O-boards attached after power-on will be detected within minutes. If no Modbus requests for a particular board have been received from a master in 90s, communication with that board will be suspended. When board is in a suspended state in the gateway, no more communication will occur with that board which will eventually trigger it to do a warm reboot. Communication will automatically be resumed on next Modbus request.On multiple subsequent errors from a board, for instance checksum errors or no response, the board will be put in an error state. In this case the gateway will try to resume communication with the board every 30 seconds.

For Modbus addressing see the chapter 5.

4. Scaling

Analog input signals needs to be scaled with respect to the range of the measured signal. Function blocks that handle these calculations are available. Contact INUX for more information.

Below are examples on calculations of measured values for different measurement ranges.

4.1. Calculation of measured value

Calculation is done using the following formula

$$v = Scale_{min} + \frac{(Scale_{max} - Scale_{min}) * r}{4000}$$

where *r* corresponds to the value returned via Modbus from the I/O-Gateway.

4.1.1. Sensor Pt100

Measurement range -50°C to 150°C.

$$v = -50 + \frac{(150 - (-50)) * r}{4000}$$

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4.1.2. Sensor 0-10V or 0-20mA

Measurement range 0 to 100.

$$v = 0 + \frac{(100-0)*r}{4000}$$

4.1.3. Sensor 2-10V or 4-20mA

For sensors of this kind that utilizes part of the input signal range, 0-10V or 0-20mA, special care needs to be taken that scale is determined based on the complete input signal range.

$$Scale_{min} = Range_{min} - \frac{Range_{max} - Range_{min}}{4}$$

Example using measurement range -25 to 75

$$Scale_{min} = \frac{75-(-25)}{4} = -50$$

i.e. measurement range in this case is specified as -50 to 75 in the formula for calculating the measured value (4.1).

Sensor with measurement range 0 to 100 is specified as -25 to 100.
Sensor with measurement range 0 to 50 is specified as -12.5 to 50.
Sensor with measurement range -50 to 50 is specified as -75 to 50.

5. Modbus addressing

Addressing is done using address base 1 (standard Modbus addressing.) If the Modbus master uses base 0 (protocol addressing) subtract 1 from the register address given below when addressing the gateway.

5.1.Register types

Register type	***Scale/range***	***Unit***	***Description***
Digital I/O	0/1		Digital signal off/on.
Digital pulse counter	0..65535		Data type is 16-bit unsigned integer. Be aware that the range of this type may overflow. The value is not persistent between power cycles.
Analog input	0..4000		The value needs to be scaled with respect to the range of the measured signal. See chapter 4.
Analog output	0..1000	1/10%	Output signal 0-100%.
PWM duty cycle	0..10000	1/100%	Specifies 0-100% of the cycle time.
PWM min. pulse	0..10000	1/10s	Specifies minimum pulse time.
PWM cycle time	0..10000	s	Specifies cycle time.
Board type	0..2		0=Undefined 1=Digital board 2=Analog board

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Register type	*Scale/range*	*Unit*	*Description*
Board state	0..3		0=Undefined 1=OK 2=Error 3=Waiting for suspension (poll timeout) 4=Suspended (poll timeout)
Board major version			H/W revision
Board minor version			H/W revision

5.2.Holding registers

	Digital board		*Analog board*	
Holding register	Read register	Write register	Read register	Write register
Board number: 1 <= x <= 16				
x00	Get DI1..DI16 (LSB = DI1)			
x01	Get DI1			
x02	Get DI2			
x03	Get DI3			
x04	Get DI4			
x05	Get DI5			
x06	Get DI6			
x07	Get DI7			
x08	Get DI8			
x09	Get DI9			
x10	Get DI10			
x11	Get DI11			
x12	Get DI12			
x13	Get DI13			
x14	Get DI14			
x15	Get DI15			
x16	Get DI16			
x17				
x18				
x19				
x20	Get DO1..DO12 (LSB = DO1)	Set DO1..DO12 (LSB = DO1)		
x21	Get DO1	Set DO1		
x22	Get DO2	Set DO2		
x23	Get DO3	Set DO3		
x24	Get DO4	Set DO4		
x25	Get DO5	Set DO5		
x26	Get DO6	Set DO6		
x27	Get DO7	Set DO7		
x28	Get DO8	Set DO8		
x29	Get DO9	Set DO9		
x30	Get DO10	Set DO10		
x31	Get DO11	Set DO11		
x32	Get DO12	Set DO12		
x33				
x34				
x35				
x36				
x37				
x38	Get DI1 pulse counter			

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	Digital board		*Analog board*	
Holding register	Read register	Write register	Read register	Write register
x39	Get DI2 pulse counter			
x40	Get DI3 pulse counter			
x41	Get DI4 pulse counter		Get AI1	
x42	Get DI5 pulse counter		Get AI2	
x43	Get DI6 pulse counter		Get AI3	
x44	Get DI7 pulse counter		Get AI4	
x45	Get DI8 pulse counter		Get AI5	
x46	Get DI9 pulse counter		Get AI6	
x47	Get DI10 pulse counter		Get AI7	
x48	Get DI11 pulse counter		Get AI8	
x49	Get DI12 pulse counter			
x50	Get DI13 pulse counter			
x51	Get DI14 pulse counter		Get AI1 error status	
x52	Get DI15 pulse counter		Get AI2 error status	
x53	Get DI16 pulse counter		Get AI3 error status	
x54			Get AI4 error status	
x55			Get AI5 error status	
x56			Get AI6 error status	
x57			Get AI7 error status	
x58	Get DO1 PWM duty cycle	Set DO1 PWM duty cycle	Get AI8 error status	
x59	Get DO2 PWM duty cycle	Set DO2 PWM duty cycle		
x60	Get DO3 PWM duty cycle	Set DO3 PWM duty cycle		
x61	Get DO4 PWM duty cycle	Set DO4 PWM duty cycle	Get AO1	Set AO1
x62	Get DO5 PWM duty cycle	Set DO5 PWM duty cycle	Get AO2	Set AO2
x63	Get DO6 PWM duty cycle	Set DO6 PWM duty cycle	Get AO3	Set AO3
x64	Get DO7 PWM duty cycle	Set DO7 PWM duty cycle	Get AO4	Set AO4
x65	Get DO8 PWM duty cycle	Set DO8 PWM duty cycle	Get AO5 (REV.2)	Set AO5 (REV.2)
x66	Get DO9 PWM duty cycle	Set DO9 PWM duty cycle	Get AO6 (REV.2)	Set AO6 (REV.2)
x67	Get DO10 PWM duty cycle	Set DO10 PWM duty cycle	Get AO7 (REV.2)	Set AO7 (REV.2)
x68	Get DO11 PWM duty cycle	Set DO11 PWM duty cycle	Get AO8 (REV.2)	Set AO8 (REV.2)
x69	Get DO12 PWM duty cycle	Set DO12 PWM duty cycle		
x70	Get DO1 PWM min. pulse	Set DO1 PWM min. pulse		
x71	Get DO2 PWM min. pulse	Set DO2 PWM min. pulse		
x72	Get DO3 PWM min. pulse	Set DO3 PWM min. pulse		
x73	Get DO4 PWM min. pulse	Set DO4 PWM min. pulse		
x74	Get DO5 PWM min. pulse	Set DO5 PWM min. pulse		
x75	Get DO6 PWM min. pulse	Set DO6 PWM min. pulse		
x76	Get DO7 PWM min. pulse	Set DO7 PWM min. pulse		
x77	Get DO8 PWM min. pulse	Set DO8 PWM min. pulse		
x78	Get DO9 PWM min. pulse	Set DO9 PWM min. pulse		
x79	Get DO10 PWM min. pulse	Set DO10 PWM min. pulse		
x80	Get DO11 PWM min. pulse	Set DO11 PWM min. pulse		
x81	Get DO12 PWM min. pulse	Set DO12 PWM min. pulse		
x82	Get DO1 PWM cycle time	Set DO1 PWM cycle time		
x83	Get DO2 PWM cycle time	Set DO2 PWM cycle time		
x84	Get DO3 PWM cycle time	Set DO3 PWM cycle time		
x85	Get DO4 PWM cycle time	Set DO4 PWM cycle time		
x86	Get DO5 PWM cycle time	Set DO5 PWM cycle time		
x87	Get DO6 PWM cycle time	Set DO6 PWM cycle time		
x88	Get DO7 PWM cycle time	Set DO7 PWM cycle time		
x89	Get DO8 PWM cycle time	Set DO8 PWM cycle time		
x90	Get DO9 PWM cycle time	Set DO9 PWM cycle time		
x91	Get DO10 PWM cycle time	Set DO10 PWM cycle time		
x92	Get DO11 PWM cycle time	Set DO11 PWM cycle time		

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	Digital board		***Analog board***	
Holding register	Read register	Write register	Read register	Write register
x93	Get DO12 PWM cycle time	Set DO12 PWM cycle time		
x94				
x95				
x96	Get board state		Get board state	
x97	Get board type		Get board type	
x98	Get board major version		Get board major version	
x99	Get board minor version		Get board minor version	
..	..	..	..	..
2000..2255 (16 boards x 16 inputs)	Get DI1..DI16			
2256..2447 (16 boards x 12 outputs)	Get DO1..DO12	Set DO1..DO12		
2448..2575 (16 boards x 8 inputs)			Get AI1..AI8	
2576..2703 (16 boards x 8 outputs)			Get AO1..AO8	Set AO1..AO8
2704..2959 (16 boards x 16 counters)	Get DI1..DI16 pulse			
2960..3151 (16 boards x 12 outputs)	Get DO1..DO12 PWM duty cycle	Set DO1..DO12 PWM duty cycle		
3152..3343 (16 boards x 12 outputs)	Get DO1..DO12 PWM min. pulse	Set DO1..DO12 PWM min. pulse		
3344..3535 (16 boards x 12 outputs)	Get DO1..DO12 PWM cycle time	Set DO1..DO12 PWM cycle time		
3536..3551 (16 boards)	Get board state		Get board state	
3552..3567 (16 boards)	Get board type		Get board type	
3568..3583 (16 boards)	Get board major version		Get board major version	
3584..3599 (16 boards)	Get board minor version		Get board minor version	

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5.3.Input registers

	Digital board	*Analog board*
Input register	Read register	Read register
Board number: 1 <= x <= 16		
x00	Get DI1..DI16 (LSB = DI1)	
x01	Get DI1	
x02	Get DI2	
x03	Get DI3	
x04	Get DI4	
x05	Get DI5	
x06	Get DI6	
x07	Get DI7	
x08	Get DI8	
x09	Get DI9	
x10	Get DI10	
x11	Get DI11	
x12	Get DI12	
x13	Get DI13	
x14	Get DI14	
x15	Get DI15	
x16	Get DI16	
x17		
x18		
x19		
x20	Get DO1..DO12 (LSB = DO1)	
x21	Get DO1	
x22	Get DO2	
x23	Get DO3	
x24	Get DO4	
x25	Get DO5	
x26	Get DO6	
x27	Get DO7	
x28	Get DO8	
x29	Get DO9	
x30	Get DO10	
x31	Get DO11	
x32	Get DO12	
x33		
x34		
x35		
x36		
x37		
x38	Get DI1 pulse counter	
x39	Get DI2 pulse counter	
x40	Get DI3 pulse counter	
x41	Get DI4 pulse counter	Get AI1
x42	Get DI5 pulse counter	Get AI2
x43	Get DI6 pulse counter	Get AI3
x44	Get DI7 pulse counter	Get AI4
x45	Get DI8 pulse counter	Get AI5
x46	Get DI9 pulse counter	Get AI6
x47	Get DI10 pulse counter	Get AI7
x48	Get DI11 pulse counter	Get AI8
x49	Get DI12 pulse counter	

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	Digital board	*Analog board*
Input register	Read register	Read register
x50	Get DI13 pulse counter	
x51	Get DI14 pulse counter	Get AI1 error status
x52	Get DI15 pulse counter	Get AI2 error status
x53	Get DI16 pulse counter	Get AI3 error status
x54		Get AI4 error status
x55		Get AI5 error status
x56		Get AI6 error status
x57		Get AI7 error status
x58	Get DO1 PWM duty cycle	Get AI8 error status
x59	Get DO2 PWM duty cycle	
x60	Get DO3 PWM duty cycle	
x61	Get DO4 PWM duty cycle	Get AO1
x62	Get DO5 PWM duty cycle	Get AO2
x63	Get DO6 PWM duty cycle	Get AO3
x64	Get DO7 PWM duty cycle	Get AO4
x65	Get DO8 PWM duty cycle	Get AO5 (REV.2)
x66	Get DO9 PWM duty cycle	Get AO6 (REV.2)
x67	Get DO10 PWM duty cycle	Get AO7 (REV.2)
x68	Get DO11 PWM duty cycle	Get AO8 (REV.2)
x69	Get DO12 PWM duty cycle	
x70	Get DO1 PWM min. pulse	
x71	Get DO2 PWM min. pulse	
x72	Get DO3 PWM min. pulse	
x73	Get DO4 PWM min. pulse	
x74	Get DO5 PWM min. pulse	
x75	Get DO6 PWM min. pulse	
x76	Get DO7 PWM min. pulse	
x77	Get DO8 PWM min. pulse	
x78	Get DO9 PWM min. pulse	
x79	Get DO10 PWM min. pulse	
x80	Get DO11 PWM min. pulse	
x81	Get DO12 PWM min. pulse	
x82	Get DO1 PWM cycle time	
x83	Get DO2 PWM cycle time	
x84	Get DO3 PWM cycle time	
x85	Get DO4 PWM cycle time	
x86	Get DO5 PWM cycle time	
x87	Get DO6 PWM cycle time	
x88	Get DO7 PWM cycle time	
x89	Get DO8 PWM cycle time	
x90	Get DO9 PWM cycle time	
x91	Get DO10 PWM cycle time	
x92	Get DO11 PWM cycle time	
x93	Get DO12 PWM cycle time	
x94		
x95		
x96	Get board state	Get board state
x97	Get board type	Get board type
x98	Get board major version	Get board major version
x99	Get board minor version	Get board minor version
..	..	..
2000..2255 (16 boards x 16 inputs)	Get DI1..DI16	
2256..2447 (16 boards x 12 outputs)	Get DO1..DO12	

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	Digital board	*Analog board*
Input register	Read register	Read register
2448..2575 (16 boards x 8 inputs)		Get AI1..AI8
2576..2703 (16 boards x 8 outputs)		Get AO1..AO8
2704..2959 (16 boards x 16 counters)	Get DI1..DI16 pulse	
2960..3151 (16 boards x 12 outputs)	Get DO1..DO12 PWM duty cycle	
3152..3343 (16 boards x 12 outputs)	Get DO1..DO12 PWM min. pulse	
3344..3535 (16 boards x 12 outputs)	Get DO1..DO12 PWM cycle time	
3536..3551 (16 boards)	Get board state	Get board state
3552..3567 (16 boards)	Get board type	Get board type
3568..3583 (16 boards)	Get board major version	Get board major version
3584..3599 (16 boards)	Get board minor version	Get board minor version

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5.4.Discrete inputs

	Digital board	*Analog board*
Input	Read input	Read input
Board number: 1 <= x <= 16		
x00		
x01	Get DI1	
x02	Get DI2	
x03	Get DI3	
x04	Get DI4	
x05	Get DI5	
x06	Get DI6	
x07	Get DI7	
x08	Get DI8	
x09	Get DI9	
x10	Get DI10	
x11	Get DI11	
x12	Get DI12	
x13	Get DI13	
x14	Get DI14	
x15	Get DI15	
x16	Get DI16	
x17		
x18		
x19		
x20		
x21	Get DO1	
x22	Get DO2	
x23	Get DO3	
x24	Get DO4	
x25	Get DO5	
x26	Get DO6	
x27	Get DO7	
x28	Get DO8	
x29	Get DO9	
x30	Get DO10	
x31	Get DO11	
x32	Get DO12	
x33		
x34		
x35		
x36		
x37		
x38		
x39		
x40		
x41		
x42		
x43		
x44		
x45		
x46		
x47		
x48		
x49		

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	Digital board	*Analog board*
Input	Read input	Read input
x50		
x51		Get AI1 error status
x52		Get AI2 error status
x53		Get AI3 error status
x54		Get AI4 error status
x55		Get AI5 error status
x56		Get AI6 error status
x57		Get AI7 error status
x58		Get AI8 error status
x59		
x60		
x61		
x62		
x63		
x64		
x65		
x66		
x67		
x68		
x69		
x70		
x71		
x72		
x73		
x74		
x75		
x76		
x77		
x78		
x79		
x80		
x81		
x82		
x83		
x84		
x85		
x86		
x87		
x88		
x89		
x90		
x91		
x92		
x93		
x94		
x95		
x96		
x97		
x98		
x99		
..	..	..
2000..2255 (16 boards x 16 inputs)	Get DI1..DI16	
2256..2447 (16 boards x 12 outputs)	Get DO1..DO12	

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5.5.Coils

	Digital board		*Analog board*	
Coil	Read coil	Write coil	Read coil	Write coil
Board number: 1 <= x <= 16				
x00				
x01	Get DI1			
x02	Get DI2			
x03	Get DI3			
x04	Get DI4			
x05	Get DI5			
x06	Get DI6			
x07	Get DI7			
x08	Get DI8			
x09	Get DI9			
x10	Get DI10			
x11	Get DI11			
x12	Get DI12			
x13	Get DI13			
x14	Get DI14			
x15	Get DI15			
x16	Get DI16			
x17				
x18				
x19				
x20				
x21	Get DO1	Set DO1		
x22	Get DO2	Set DO2		
x23	Get DO3	Set DO3		
x24	Get DO4	Set DO4		
x25	Get DO5	Set DO5		
x26	Get DO6	Set DO6		
x27	Get DO7	Set DO7		
x28	Get DO8	Set DO8		
x29	Get DO9	Set DO9		
x30	Get DO10	Set DO10		
x31	Get DO11	Set DO11		
x32	Get DO12	Set DO12		
x33				
x34				
x35				
x36				
x37				
x38				
x39				
x40				
x41				
x42				
x43				
x44				
x45				
x46				
x47				
x48				
x49				
x50				

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	Digital board		*Analog board*	
Coil	Read coil	Write coil	Read coil	Write coil
x51			Get AI1 error status	
x52			Get AI2 error status	
x53			Get AI3 error status	
x54			Get AI4 error status	
x55			Get AI5 error status	
x56			Get AI6 error status	
x57			Get AI7 error status	
x58			Get AI8 error status	
x59				
x60				
x61				
x62				
x63				
x64				
x65				
x66				
x67				
x68				
x69				
x70				
x71				
x72				
x73				
x74				
x75				
x76				
x77				
x78				
x79				
x80				
x81				
x82				
x83				
x84				
x85				
x86				
x87				
x88				
x89				
x90				
x91				
x92				
x93				
x94				
x95				
x96				
x97				
x98				
x99				
..	..	..	..	..
2000..2255 (16 boards x 16 inputs)	Get DI1..DI16			
2256..2447 (16 boards x 12 outputs)	Get DO1..DO12	Set DO1..DO12		

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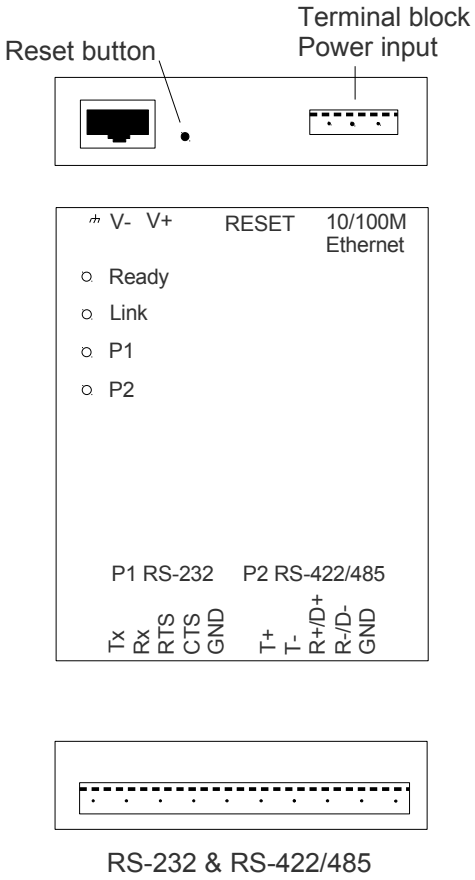
6. Hardware introduction

The HWIO-Gateway has one Ethernet port (RJ45), one 10-pin teminal block with 5 pins used for one RS232 port and 5 pins used for one RS-422/485 port and a 3-pin terminal block for power supply.



RS-232 & RS-422/485

LED Indicators – The device have four LED indicators, as described in the following table.

LED Name	LED color	LED function
Ready	red	Steady on: Power is on and device is booting up.
Ready	green	Steady on: Power is on and device is functioning normally.
Ready	off	Power is off or error condition exists.
Link	orange	10 Mbps Ethernet connection
Link	green	100 Mbps Ethernet connection
Link	off	Ethernet cable is disconnected or has a short
P1,P2	orange	Serial port is receiving data
P1,P2	green	Serial port is transmitting data
P1,P2	off	No data is beeing transmitted or received through the serial port

7. Gateway installation procedure

STEP 1: Connect the RS485 serial port (P2) on the gateway to the "daisy chain" of I/O-modules. Termination is done in both ends of the chain. This is normally done with a 120 ohm resistor between the D+ and D- data lines. Note that the on-board terminators of the revision 2.x I/O-boards must not be used. However, the on-board terminators of the earlier I/O-boards may be used.

Note! To protect the lines from ground loops and other electrical problems, use an RS485 repeater with opto-isolation. This is particularly important when using distributed I/O-boards.

STEP 2: Connect a 12–30VDC power line to the device terminal block.

STEP 3: Connect the gateway to a network. Use a standard straight-through Ethernet cable to connect to a hub or a switch. When setting up or testing the gateway, you might find it convenient to connect directly to your computer's Ethernet port. In this case, use a cross-over Ethernet cable.

STEP 4: Use a web browser to do the necessary IP-configuration of the gateway.

STEP 5: By default the Gatway communicates with the master unit using Modbus-TCP (ethernet). In case Modbus-RTU via RS-232 (P1) is required, this needs to be configured in the web interface as well.

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8. Environmental specifications

Power requirements	Gateway	12 to 48 VDC 305 mA at 12 VDC (max)
Operating temp.		0 to 55°C
Operating humidity		5 to 95%rH
Dimensions (WxDxH)	(including ears)	90 x 100.4 x 22 mm
	(without ears)	67 x 100.4 x 22 mm
Surge protection		15kV ESD for serial ports
Magnetic isolation		1.5 kV for Ethernet port
Power line protection		4kV Burst (EFT) EN61000-4-4

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